Phytoplankton as Bio Indicators in Management of Eutrophication problem of Kandy Lake

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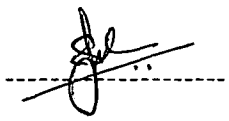
Declaration

This dissertation has not been previously presented in whole or part to any university or institute for a higher degree.



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I certify that the above statement made by the candidate is true and that this thesis is suitable for submission to the university for the purpose of evaluation.

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This thesis is affectionately dedicated

to

my loving husband

Whose enthusiastic encouragement made me to achieve success in

my post graduate studies

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Abstract

Eutrophication through the process of nutrient enrichment of stagnant waters due to urbanization & agricultural practices is becoming a significant water pollution issue in Sri Lanka. The appearance of thick *Microcystis aeruginosa* bloom in 1999 indicates that the Kandy Lake is also becoming the victim of nutrient enrichment. Therefore an effective Lake Management and Lake monitoring programmes with integrated catchment management have to be adopted and it is a prior necessity in planning of the management practices of the catchments to get firsthand information through research on trophic status of the lake.

This study is focused on the evaluation of trophic status of the lake using Phytoplankton as indicators. The objectives of the study were to find out the species composition, variation of species richness & their diversity towards the trophic nature of Kandy lake through responses of the species towards different nutrient levels of the lake, and to develop different diversity index ranges which could be used as indicator levels of Lake Eutrophication, thus making it possible to determine the status of the water body through diversity index values.

To achieve these objectives, the overall physico-chemical nature of the water body, was investigated by the parameters such as water level, water transparency, dissolved oxygen, temperature, conductivity, pH, alkalinity, nitrate, orthophosphate and biological nature by the parameters such as chlorophyll - *a* and the phytoplankton densities and species composition were determined. The laboratory experiments also were conducted using a series of diluted lake water as culture media to monitor the effect of Nitrate & Phosphate on indicator organisms. Sampling was carried out in Kandy Lake from October 2001 to March 2002 (six months), once a month during the day time.

The total number of individual species collected at 08 selected stations at each depth surface, mid and bottom were quantified and the phytoplankton density was expressed as the number of cells per cubic meter of the lake water. These data were used in calculating diversity indices.

During this study an attempt was made to develop a curve to predict the number of cells in a colony according to the size of the colony of *Microcystis*. According to the curve there were 20 cells per unit area ($1\mu m^2$) of *Microcystis* colony.

Low Secchi Depth value (<1m) and high chlorophyll *a* concentration (100-250 mg/m^3) indicates Hyper-eutrophic nature of the Lake. High nutrient loading observed through out the study period (Average values of Nutrients varied between 204.65µg/L and 512.95µg/L for Orthophosphate and 0.114 mg/L and 0.243 mg/L for Nitrate) triggers that situation and it probably maximized by the mixing nature of the lake.

Only a few (06) phytoplankton species were recorded in Kandy Lake during the study period; namely *Microcystis aeruginosa*, *Microcystis incerta*, *Pediastrum duplex*, *Merismopedia tenuissima*, *Melosira granulata*, *Diatoma elongata*. Out of

them *Microcystis* and *Melosira* were found in greater abundance indicating the eutrophic nature of the lake.

The calculated diversity index values for water samples of entire Kandy Lake throughout the investigation period were below 1.0. According to previous studies diversity index <1 is eutrophicated and >3 is clean water. Therefore values obtained for Kandy Lake indicates the eutrophicated status of the lake. Even during different seasons the values have never increased indicating permanent eutrophic status of Kandy Lake. The diversity index value of <1 found for Kandy Lake could be used as a reference value to monitor the trends during restoration of the Lake.

According to the physico chemical and biological observations of the present investigations, Kandy lake water is already eutrophic and therefore its bottom sediment may contain high nutrient concentrations adsorbed to the bottom sediment. Therefore even if further nutrient inputs are controlled, the blooming could occur due to accumulated nutrient loads in the bottom and there is a need for quick remedial efforts if the Lake is to be saved from this bad situation.

Diversity index values could be used as a monitoring tool in Management of Eutrophication in Kandy Lake even without time consuming and costly chemical analysis procedures.

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